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(FILE 'HOME' ENTERED AT 14:40:36 ON 05 MAR 2004)

FILE 'STNGUIDE' ENTERED AT 14:40:41 ON 05 MAR 2004

FILE 'INSPEC' ENTERED AT 14:41:18 ON 05 MAR 2004

L1 14049 SOLAR (A) CELL
L2 126797 FLEXIB#####
L3 17470 NACL
L4 12 DISOLV#####
L5 12 DISOLV#####
L6 7 L AND L2 AND L3
L7 14 DHIS

FILE 'CA' ENTERED AT 14:47:23 ON 05 MAR 2004

L8 683519 SUBSTRATE
L9 4 L1 AND L2 AND L3 AND L8

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=> file ca
COST IN U.S. DOLLARS
FULL ESTIMATED COST

SINCE FILE	TOTAL
ENTRY	SESSION
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FILE COVERS 1907 - 4 Mar 2004 VOL 140 ISS 11
FILE LAST UPDATED: 4 Mar 2004 (20040304/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> substrate
L8 683519 SUBSTRATE

=> l1 and l2 and l3 and l8
115654 SOLAR
1692128 CELL
33563 SOLAR (A)CELL
112567 FLEXIB#####
252237 NACL
L9 4 L1 AND L2 AND L3 AND L8

=> d l9 1-4 all

L9 ANSWER 1 OF 4 CA COPYRIGHT 2004 ACS on STN
AN 137:127459 CA
ED Entered STN: 22 Aug 2002
TI Low temperature growth of CIGS thin films for **flexible** solar cells
AU Rudmann, D.; Haug, F.-J.; Kaelin, M.; Zogg, H.; Tiwari, A. N.; Bilger, G.
CS Laboratory for Solid State Physics, Thin Film Physics Group, ETH Zurich, Technopark, Zurich, CH-8005, Switz.
SO Materials Research Society Symposium Proceedings (2001), 668(II-VI Compound Semiconductor Photovoltaic Materials), H3.8/1-H3.8/6
CODEN: MRSPDH; ISSN: 0272-9172
PB Materials Research Society
DT Journal
LA English
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
AB Low **substrate** temps. have to be used for polymer substrates. Therefore, using soda lime glass (SLG) substrates with and without an alkali barrier (Al2O3), a three-step CIGS coevaporation process for a **substrate** temperature of 450° was developed and compared to film deposition with constant evaporation rates. The three-step process enhanced grain nucleation. An efficiency of 14.0% was achieved with this process for solar cells on SLG. Since polymers in general do not contain Na, a

way of Na addition to the absorber is needed. NaF coevaporation can be used to control the Na content in CIGS. Also, incorporation of Na in CIGS by diffusion from a NaCl layer through a polyimide is demonstrated. With such SLG/NaCl/polyimide structures, **flexible** solar cells can be obtained using a lift-off process. A cell efficiency of 11.6% (0.99 cm² area) has been achieved.

- ST **flexible solar cell copper indium gallium selenide thin film; soda lime substrate copper indium gallium selenide film**
- IT Vapor deposition process
(chemical, of CIGS thin films; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT Solar cells
(low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT Polyimides, uses
Soda-lime glasses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(**substrate**; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT 1344-28-1, Aluminum oxide (Al₂O₃), uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(alkali barrier; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT 7681-49-4, Sodium fluoride, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(sodium source; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT 7647-14-5, Sodium chloride, uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(substrates containing; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)
- IT 111419-77-3, Copper gallium indium selenide (Cu(Ga,In)Se₂)
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)
(thin films; low-temperature growth of copper indium gallium selenide thin films on soda lime glass **substrate** for **flexible** solar cells)

RE.CNT 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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- (2) Bodegard, M; Thin Solid Films 2000, V361, P9
- (3) Contreras, M; 26th IEEE PVSC 1997
- (4) Granath, K; Sol En Mat & Solar Cells 2000, V60, P279 CA
- (5) Hartmann, M; Proc 28th IEEE PVSC 2000
- (6) Kimura, R; Jpn J Appl Phys 1999, V38, PL289 CA
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- (8) Matson, R; Young in NCPV Photovoltaic Program Review 1999, P542 CA

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- (12) Tiwari, A; Progr PV: Res & Appl 1999, V7, P393 CA
- (13) Tuttle, J; Proc 28th IEEE PVSC 2000

L9 ANSWER 2 OF 4 CA COPYRIGHT 2004 ACS on STN

AN 135:259727 CA

ED Entered STN: 18 Oct 2001

TI Development of **flexible** Cu(In,Ga)Se₂ solar cells on polymers with lift-off processes

AU Rudmann, D.; Haug, F.-J.; Krejci, M.; Zogg, H.; Tiwari, A. N.

CS Institute of Quantum Electronics, Thin Film Physics Group, ETH Zurich, Zurich, CH-8005, Switz.

SO European Photovoltaic Solar Energy Conference, Proceedings of the International Conference, 16th, Glasgow, United Kingdom, May 1-5, 2000 (2000), Volume 1, 298-301. Editor(s): Scheer, Hermann. Publisher: James & James (Science Publishers) Ltd., London, UK.
CODEN: 69BOEK

DT Conference

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

AB The choice of an appropriate **substrate** is very important for the development of lightwt. and **flexible** Cu(In,Ga)Se₂ (CIGS) solar cells. Because of high CIGS deposition temps. the choice of polymer substrates is restricted to polyimides. We have developed a process where high temperature stable polyimides with tailored thermophys. properties can be used. Using a **NaCl** buffer layer and a lift-off process 12.8% efficiency CIGS solar cells have been grown on a 20 µm thin polyimide film. In another approach the CIGS cells are grown at >500° on a glass **substrate** covered with a buffer layer. A transparent polymer is applied after growth of the **solar cell** and the buffer layer is subsequently dissolved. Solar cells with an efficiency of 8% have been obtained.

ST copper gallium indium selenide **flexible solar cell**; polyimide copper gallium indium selenide **flexible solar cell**

IT Solar cells

(development of **flexible** copper gallium indium selenide solar cells on polymers using lift-off processes)

IT Polyimides, uses

RL: NUU (Other use, unclassified); USES (Uses)

(development of **flexible** copper gallium indium selenide solar cells on polymers using lift-off processes)

IT 7647-14-5, Sodium chloride, uses

RL: NUU (Other use, unclassified); USES (Uses)

(buffer layer; in development of **flexible** copper gallium indium selenide solar cells on polymers using lift-off processes)

IT 111419-77-3, Copper gallium indium selenide [Cu(Ga,In)Se₂]

RL: DEV (Device component use); USES (Uses)

(development of **flexible** copper gallium indium selenide solar cells on polymers using lift-off processes)

RE.CNT 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

(1) Basol, B; 25th IEEE Photovol Spec Conf 1988-1996, P157

(2) Burgess, R; Proc 20th IEEE Photovol Spec Conf 1988, P909 CA

(3) Contreras, M; Progress in Photovoltaics 1999, V7, P311 CA

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(7) Negami, T; Technical Digest of the International PVSEC-11 1999, P993

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Energy Conversion 1998, P3586

(10) Tiwari, A; Progress in Photovoltaics: Research and Applications 1999, V7, P393 CA

(11) Wiedeman, S; Proc NCPV Program Review Meeting 1999, P17 CA

L9 ANSWER 3 OF 4 CA COPYRIGHT 2004 ACS on STN

AN 134:88850 CA

ED Entered STN: 01 Feb 2001

TI **Flexible thin-layer solar cell**

IN Tiwari, Ayodhya N.; Krejci, Martin; Haug, Franz Josef; Zogg, Hans

PA Eidgenossische Technische Hochschule (ETH), Switz.

SO PCT Int. Appl., 19 pp.

CODEN: PIXXD2

DT Patent

LA German

IC ICM H01L031-18

ICS H01L031-032; H01L031-0392

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2001004964	A1	20010118	WO 2000-CH379	20000712
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	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				
	RW:				
	GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG				
	EP 1200995	A1	20020502	EP 2000-940105	20000712
	R:				
	AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL				
	JP 2003504877	T2	20030204	JP 2001-509094	20000712
PRAI	CH 1999-1287	A	19990713		
	WO 2000-CH379	W	20000712		

AB A method is disclosed for producing a **flexible thin-layer solar cell**. An intermediate layer, known as a sacrificial layer, for example **NaCl**, is applied to a rigid **substrate** and a carrier layer, for example, a polyimide is deposited thereon. Addnl. layers are then deposited onto the support layer, for example, Mo, a **CuInxGaySzSeu** absorber with x, y, z, u ≥ 0 , a **CdS-ZnO** window layer and a transparent front contact, the structuring of the cells is completed and they are optionally provided with a coating. The **solar cell** structure is separated from the rigid **substrate** by the dissoln. of the sacrificial layer, whereby the resultant **solar cell** becomes **flexible**. The invention relates to **flexible solar cells** produced by this method which have typical thicknesses of 25 μm with approx. 13% efficiency. Large-surface cells can be used for energy production both on earth and in space, while small-surface cells can be used for powering electronic goods, such as for example, pocket calculators and smart cards.

ST **solar cell flexible**

IT Solar cells

(fabrication and performance of **flexible thin-layer solar cell**)

IT Polyimides, uses

RL: TEM (Technical or engineered material use); USES (Uses)

(fabrication and performance of **flexible thin-layer solar cell**)

IT Alkaline earth fluorides

RL: TEM (Technical or engineered material use); USES (Uses)

(fluorides, sacrificial layer; fabrication and performance of **flexible thin-layer solar cell**)

IT Alkali metal halides, uses
 RL: TEM (Technical or engineered material use); USES (Uses)
 (sacrificial layer; fabrication and performance of **flexible thin-layer solar cell**)

IT 1306-23-6, Cadmium sulfide, uses 1314-13-2, Zinc oxide, uses
 7439-98-7, Molybdenum, uses 176655-87-1, Copper gallium indium selenide
 sulfide
 RL: DEV (Device component use); USES (Uses)
 (fabrication and performance of **flexible thin-layer solar cell**)

IT 7447-40-7, Potassium chloride, uses 7647-14-5, Sodium chloride, uses
 7681-49-4, Sodium fluoride, uses 7787-32-8, Barium fluoride
 RL: TEM (Technical or engineered material use); USES (Uses)
 (sacrificial layer; fabrication and performance of **flexible thin-layer solar cell**)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD
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- (3) Basol, B; "COPPER INDIUM DISELENIDE THIN FILM SOLAR CELLS FABRICATED ON FLEXIBLE FOIL SUBSTRATES", SOLAR ENERGY MATERIALS AND SOLAR CELLS 1993, V29(2), P163 CA
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- (6) Kawanishi, Y; US 5232860 A 1993 CA
- (7) Landis, G; SOLAR CELLS 1990, V29(2 / 03), P257
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- (9) Sanyo Electric Co Ltd; JP 01105581 A 1989
- (10) Univ Delaware; DE 2447066 A 1975 CA

L9 ANSWER 4 OF 4 CA COPYRIGHT 2004 ACS on STN
 AN 132:13850 CA
 ED Entered STN: 01 Jan 2000
 TI 12.8% efficiency Cu(In,Ga)Se₂ **solar cell** on a **flexible** polymer sheet
 AU Tiwari, A. N.; Krejci, M.; Haug, F.-J.; Zogg, H.
 CS Thin Film Physics Group, Institute of Quantum Electronics, ETH (Swiss Federal Institute of Technology) Zurich, Zurich, CH-8005, Switz.
 SO Progress in Photovoltaics (1999), 7(5), 393-397
 CODEN: PPHOED; ISSN: 1062-7995
 PB John Wiley & Sons Ltd.
 DT Journal
 LA English
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 AB A lift-off process has been developed to obtain Cu(In,Ga)Se₂ solar cells on **flexible** polymer sheets. The absorber layer is grown by a co-evaporation method on a polyimide layer, which is spin coated on a **NaCl**-covered glass **substrate**. The **NaCl** intermediate layer can provide Na to the Cu(In,Ga)Se₂ layer during deposition. After the complete processing of the cells, the **NaCl** buffer layer is dissolved to sep. the glass **substrate** from the ZnO/CdS/Cu(In,Ga)Se₂/Mo/polyimide stack. A record conversion efficiency of 12.8% (total area) under air-mass 1.5 illumination was independently measured. Such high-efficiency solar cells on lightwt. and **flexible** substrates are needed for novel terrestrial and space applications.

ST copper gallium indium selenide **solar cell** polyimide sheet

IT Solar cells
 (fabrication of 12.8% efficient copper gallium indium selenide solar cells on **flexible** polymer sheet)

IT Polyimides, uses

RL: DEV (Device component use); USES (Uses)
(fabrication of 12.8% efficient copper gallium indium selenide solar cells on flexible polymer sheet)

IT 111419-77-3, Copper gallium indium selenide [Cu(Ga,In)Se₂]

RL: DEV (Device component use); USES (Uses)
(fabrication of 12.8% efficient copper gallium indium selenide solar cells on flexible polymer sheet)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Basol, B; 25th IEEE Photovoltaics Special Conference 1996, P157
- (2) Burgess, R; Proceedings of the 20th IEEE Photovoltaics Special Conference 1988, P909 CA
- (3) Contreras, M; Proceedings of the 14th European Photovoltaic Solar Energy Conference 1997, P2354
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Volume 43, Issue 1, 15 August 1996, Pages 93-98

doi:10.1016/0927-0248(95)00171-9 [? Cite or link using doi](#)
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Flexible and light weight copper indium diselenide solar cells on polyimide substrates

Bülent M. Başol^a, , Vijay K. Kapur^a, Craig R. Leidholm^a, Arvind Halani^a and Kristen Gledhill^b^a International Solar Electric Technology (ISET), 8635 Aviation Blvd., Inglewood, CA 90301, USA^b Phillips Laboratory, Kirtland Air Force Base, Albuquerque, NM 87117, USA

Received 20 July 1995. Available online 15 February 1999.

Abstract

Thin film flexible CuInSe₂ (CIS) solar cells have been fabricated for the first time on light-weight polymeric substrates. Evaporated Cu---In alloy precursors were selenized in H₂Se atmosphere at around 400°C to grow the CIS absorber layers. Low temperature techniques which are compatible with the polymeric substrates were used to deposit the window layers of CdS and ZnO. The demonstrated active area conversion efficiency of 9.3% makes this light-weight device very attractive for many terrestrial and space power generation applications where high specific power and mechanical flexibility are needed.

Author Keywords: Copper indium selenide; Flexible solar cell; Lightweight solar cell; Space solar cell



Corresponding author.

Solar Energy Materials and Solar Cells

Volume 43, Issue 1, 15 August 1996, Pages 93-98

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DATE: Friday, March 05, 2004

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END OF SEARCH HISTORY